

A review and redescription of the cosmopolitan pseudoscorpion *Chelifer cancroides* (Pseudoscorpiones: Cheliferidae)

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Abstract. The taxonomy of the cheliferid pseudoscorpion genus *Chelifer* Geoffroy 1762 is reviewed with a single cosmopolitan species, *Chelifer cancroides* (Linnaeus 1758), with the subspecies *C. cancroides orientalis* Morikawa 1954 from Japan newly synonymised with *C. cancroides*. Adults and the final two nymphal stages (tritonymph and deutonymph) are redescribed based on numerous specimens from Europe, North America, Asia and Australasia. The large size variation evident in the samples is documented. The latero-ventral process of the tarsal claws characteristically found in adults (except leg I of the male) is lacking in nymphs, a pattern that is also confirmed in the genera *Lissochelifer* Chamberlin 1932, *Lophochernes* Simon 1878 and *Parachelifer* Chamberlin 1932.

Keywords: Taxonomy, morphology, variation, new synonymy

The two pseudoscorpions described and named by Linnaeus (1758) in the 10th edition of *Systema Naturae* were both included in the mite genus *Acarus* Linnaeus 1758. *Acarus cancroides* Linnaeus 1758 was recorded from Europe and *A. scorpioides* Linnaeus 1758 from America. Both species were transferred to *Phalangium* Linnaeus 1758 by Linnaeus (1767) and then to *Scorpio* Linnaeus 1758 by Fabricius (1775), but these genera are now used exclusively in the arachnid orders Opiliones and Scorpiones, respectively. In the meantime the genus *Chelifer* was established in an anonymous work by Geoffroy (1762) to accommodate *A. cancroides* and the mite *A. longicornis* Linnaeus 1758, and has been used as a valid genus ever since despite being proposed in a publication that was eventually ruled as an unavailable work due to the inconsistent use of binominal system (International Commission on Zoological Nomenclature 1954). The genus name was conserved in a ruling by the International Commission on Zoological Nomenclature (1989) with the type species confirmed as *A. cancroides*. Since Geoffroy's publication, 346 additional species-group names have been described within the genus *Chelifer* and all except *C. cancroides orientalis* Morikawa 1954 have been either removed to other genera or synonymized with *C. cancroides* (e.g., Chamberlin 1931b, 1932; Beier 1932a, 1932b). The genus is currently monotypic (Harvey 2013), although 14 other species originally described in *Chelifer* are regarded as *nomina dubia* (Harvey 2013).

Chelifer cancroides (Linnaeus 1758) is the most widely distributed pseudoscorpion species in the world and has been recorded from 58 countries in all major biogeographic regions (summarized by Harvey 2013). Published records indicate that it occurs in a variety of habitats, but is most frequently found in human dwellings, associated buildings and bird's nests (e.g., Artault de Vevey 1901; Ewing 1911; Levi 1948; Beier 1963; Turienzo et al. 2010).

Chelifer cancroides is also one of the best known pseudoscorpions and has been used for a variety of studies including

growth, feeding (Vachon 1932, 1933, 1934a), respiration (Sláma 1995) and oogenesis and genital morphology (Vachon 1934b, 1936; Badian & Ogorzalek 1982; Badian 1987; Jędrzejowska et al. 2013).

Despite its widespread distribution and the abundance of preserved specimens in some museum collections, there are relatively few published illustrations of *C. cancroides* and there is no comprehensive modern description. To facilitate the recognition of this species, *C. cancroides* is redescribed based on a variety of specimens collected from four continents.

METHODS

This study is based upon the examination of specimens that are lodged in the American Museum of Natural History, New York (AMNH); Australian National Insect Collection, Canberra (ANIC), California Academy of Sciences, San Francisco (CAS); Florida State Collection of Arthropods, Gainesville (FSCA); Naturhistoriska Riksmuseet, Stockholm (NHRS); Queensland Museum, Brisbane (QM); Queen Victoria Museum and Art Gallery, Launceston (QVMAG); Tasmanian Museum and Art Gallery, Hobart (TMAG) and Western Australian Museum, Perth (WAM). In addition to the specimens of *C. cancroides* examined for this study (Appendix 1), specimens of other cheliferid genera were also examined to determine differences in tarsal claw morphology between adults and nymphs (see Appendix 1).

Many specimens used in this study had been previously prepared as permanent slide mounts in Canada Balsam by other researchers including J.C. Chamberlin, C.C. Hoff and W.B. Muchmore. The methods they used to prepare the slides include the removal of soft body tissue through the immersion of the specimen in potassium hydroxide (KOH) and dismemberment of the specimen to facilitate examination of important morphological features as documented by Chamberlin (1931a) and Hoff (1949). Additional specimens examined were also studied using temporary slide mounts prepared

by immersion of the specimen in lactic acid at room temperature for several hours to days and mounting them on microscope slides with 10 or 12 mm coverslips supported by small sections of 0.25, 0.35 or 0.5 mm diameter nylon fishing line. After study the specimens were returned to 75% ethanol, with the dissected portions placed in 12 × 3 mm glass genitalia microvials (BioQuip Products, Inc.). Specimens were examined with a Leica MZ-16A dissecting microscope and an Olympus BH-2 or a Leica DM2500 compound microscope, the latter fitted with interference contrast, and illustrated with the aid of a drawing tube attached to the compound microscopes. Measurements were taken at the highest possible magnification using an ocular graticule. Terminology and mensuration mostly follow Chamberlin (1931a), with the exception of the nomenclature of the pedipalps, legs and with some minor modifications to the terminology of the trichobothria (Harvey 1992), chelicera (Judson 2007) and faces of the appendages (Harvey et al. 2012). Terminology for the male genitalia are taken from Vachon (1938b) and Legg (1975).

The length and width of the pedipalpal femur and chela were measured for every specimen, even though occasionally one or more measurements were not possible due to missing, damaged or poorly aligned appendages. Some specimens, including all of the Asian specimens (which included the smallest specimens; see "Variation and the identity of *Chelifer cancroides orientalis*"), and the six largest and the six smallest specimens of each sex (based on chela length) of the larger group were measured in detail to prepare the species description and capture the greatest range of variation. Additional features such as the number of setae on the tergites and the posterior margin of the carapace were also recorded for these specimens. Means and standard deviations for the pedipalpal femur and chela measurements listed above were calculated using the AVERAGE and STDEVA functions in Excel (Microsoft Office Professional 2010). The same program was used to prepare Figs. 39–44.

SYSTEMATICS

Family Cheliferidae Risso 1827

Chelifer Geoffroy 1762

Chelifer Geoffroy 1762:617–618.

Obisium Illiger 1798:501 (synonymised by Westwood 1836:10) (see Judson 2012 for the nomenclatural history of this genus).

Type species.—*Chelifer*: *Acarus cancroides* Linnaeus 1758, by subsequent designation of Latreille, 1810:484.

Obisium: *Acarus cancroides* Linnaeus 1758, by subsequent designation of Westwood, 1836:10.

Diagnosis and description.—See below under *C. cancroides*.

Remarks.—The genus-group name *Chelifer* was first proposed by Geoffroy (1762) in an anonymous publication that was not strictly binominal. The publication was placed on the International Commission of Zoological Nomenclature's Official Index of Rejected and Invalid Works in Zoology in 1954 (Opinion 228). After receiving a submission to validate the name *Chelifer* (Harvey 1987), the name was conserved by the Commission in Opinion 1542 (International Commission on Zoological Nomenclature 1989). Geoffroy's (1762) publi-

cation was later placed on the Official List of Works Approved as Available for Zoological Nomenclature in Opinion 1754 (International Commission on Zoological Nomenclature 1994). Geoffroy included two species in *Chelifer*, *Acarus cancroides* Linnaeus 1758 and *A. longicornis* Linnaeus 1758, and the Commission recognised *Acarus cancroides* as the type species by subsequent designation of Latreille (1810).

Chelifer is the type genus of Cheliferidae and all coordinate family-group names (Cheliferoidea, Cheliferinae and Cheliferini). The tribe Cheliferini is characterized by the presence in the male of a lateral rod in which the anterior margin is deeply invaginated and usually contains a sclerotic rod-like process (Fig. 32); coxal sacs of the male, when present, lack a clearly differentiated medial atrium (Fig. 12) and the median cribriform plates of the female are distinctly paired (Fig. 34) (e.g., Beier 1932a; Chamberlin 1932; Hoff 1956). In contrast, the other cheliferine tribe, Dactylocheliferini, has uninvaginated lateral rods and lacks a sclerotic rod; the coxal sacs, when present, usually have a differentiated atrium; and the median cribriform plates are unpaired (e.g., Beier 1932a; Chamberlin 1932; Hoff 1956). This tribal classification represents one of the few within the Pseudoscorpiones characterised solely by genitalic features. There are, however, some cheliferid genera that have characteristics of both tribes, including *Mexichelifer* Muchmore 1973 that has the invaginated lateral rods and paired median cribriform plates characteristic of the Cheliferini and the distinct atrium of the coxal sac found in Dactylocheliferini (Muchmore 1973).

A distinctive feature of *C. cancroides* is the presence of a latero-ventral process on the tarsal claws of adults (Fig. 26) with the exception of leg I in males, which is modified to assist in mating (Figs. 24, 25). Several other cheliferid genera also possess such processes including the cheliferins *Cubachelifer* Hoff 1946, *Mesochelifer* Vachon 1940, *Parachelifer* Chamberlin 1932 and *Tyrannochelifer* Chamberlin 1932 (e.g., Beier 1932a; Chamberlin 1932; Hoff 1946, 1956; Mahnert 1981; Zaragoza 2009), and the dactylocheliferins *Lissochelifer* Chamberlin 1932, *Lophochernes* Simon 1878, *Mucrochelifer* Beier 1932 and *Stenochelifer* Beier 1967 (Chamberlin 1932; Beier 1932a, 1967a). This process was first reported to be lacking in the nymphal stages of *C. cancroides* by Hoff (1949), an observation that is confirmed in the present study (Figs. 27, 28). It is also absent in nymphs of two different species attributable to the genus *Lissochelifer* from northern Australia, and a species of *Lophochernes* from Vanuatu (Figs. 35, 36). Hoff (1964) reported simple claws in nymphs of three species of *Parachelifer*, in which the adults possessed claws with ventral processes. This observation is also here confirmed in a species of *Parachelifer* from Florida (Figs. 37, 38) and has been observed by J. Zaragoza (in litt., 21 June 2012) in nymphs of *Mesochelifer fradei* Vachon 1940. It is not known whether the nymphs of the other cheliferid genera listed above also lack such processes, but the pattern observed so far suggests that they are completely restricted to adults.

Most cheliferids have five setae on the cheliceral hand. All of the specimens of *C. cancroides* examined in this study have four cheliceral setae. This state is not, however, unique within the family. Species of the monotypic cheliferin genera *Kashimachelifer* Morikawa 1957 and *Mexichelifer*, and the monotypic dactylocheliferin genera *Pugnochelifer* Hoff 1964,



Figure 1.—*Chelifer cancrivorus* (Linnaeus), living male from near Prebbleton, New Zealand (image courtesy of B. Donovan).

Sinochelifer Beier 1967 and *Tetrachelifer* Beier 1967 also bear only four setae (Morikawa 1957; Hoff 1964; Beier 1967a; Muchmore 1973). Some species of *Rhacochelifer* Beier 1932 have only four cheliceral setae (Mahnert 1980; Callaini 1983; Dashdamirov & Schawaller 1995), but most have five setae. Some species of *Hysterochelifer* Chamberlin 1932 and *Paisochelifer* Hoff 1946 are reported to have either four or five cheliceral setae, and some specimens also rarely have a sixth seta located between setae *sbs* and *bs* (Hoff 1950, 1956). The missing seta in *Chelifer*, *Pngnochelifer*, *Rhacochelifer* and *Tetrachelifer* is *sbs*, which can be readily determined by comparison with other cheliferids with a full complement of five setae. The seta *ls* appears to be absent in *Kashimachelifer* based on illustrations of the chelicera by Morikawa (1957, 1960), but the missing seta of *Mexichelifer* and *Sinochelifer* has not yet been determined (Beier 1967a; Muchmore 1973).

Chelifer cancrivorus (Linnaeus 1758)
(Figs. 1–34, 39–44)

Acarus cancrivorus Linnaeus 1758:616.
Chelifer europaeus de Geer 1778:355–357, plate 19, Figs. 14, 15.
Chelifer hermanni Leach 1817:49, plate 142, Fig. 3.
Chelifer sesamoides Audouin 1826:174–175, plate 8, Fig. 4.
Chelifer ixoides Hahn 1834:53, Fig. 140 (as *Chelifer ixoides* [sic]).
Chelifer granulatus C.L. Koch 1843:37, Fig. 777.
Chelifer grandimanus C.L. Koch 1843:38–39, Fig. 778.
Chelifer rhododactylus Menge 1855:32, plate 4, Fig. 6.

Chelifer serratus Stecker 1874:235–236.

Chelifer cancrivorus dentatus Ewing 1911:73.

Chelifer cancrivorus orientalis Morikawa 1954:73–75, Figs. 2a–e.

New synonymy.

For a full bibliographic treatment, see Harvey (2013).

Material examined. See Appendix 1.

Diagnosis.—Adults of the genus *Chelifer* and the sole included species *C. cancrivorus* can be distinguished from all other cheliferids by the following combination of morphological features, none of which, however, are unique to the genus: cheliceral hand with 4 setae, with seta *sbs* absent (Fig. 14); tarsal claws of all legs, with the exception of leg I of males, with lateroventral process (Fig. 26); subterminal tarsal setae denticulate (Figs. 24, 26); carapace with large setose tubercles (Figs. 9, 10); carapace and tergites I–VII or VIII of male with distinct lateral keels (Figs. 7, 9); coxa IV of males strongly arcuate and with a large lateral process (Figs. 11, 12); coxa IV of males with coxal sac, which lacks a differentiated atrium (Fig. 12); male genitalia with rams horn organs and an anteriorly invaginated lateral rod forming a median depression, in which lies a sclerotic rod (Figs. 32, 33); and female genitalia with paired spermathecae and median cribriform plates (Fig. 34).

Description.—*Adults from near Pittsburg, Kansas, USA (AMNH Hoff slides S-4186.2, S-4186.4): Color:* sclerotized portions generally dark red-brown, males generally darker than females.



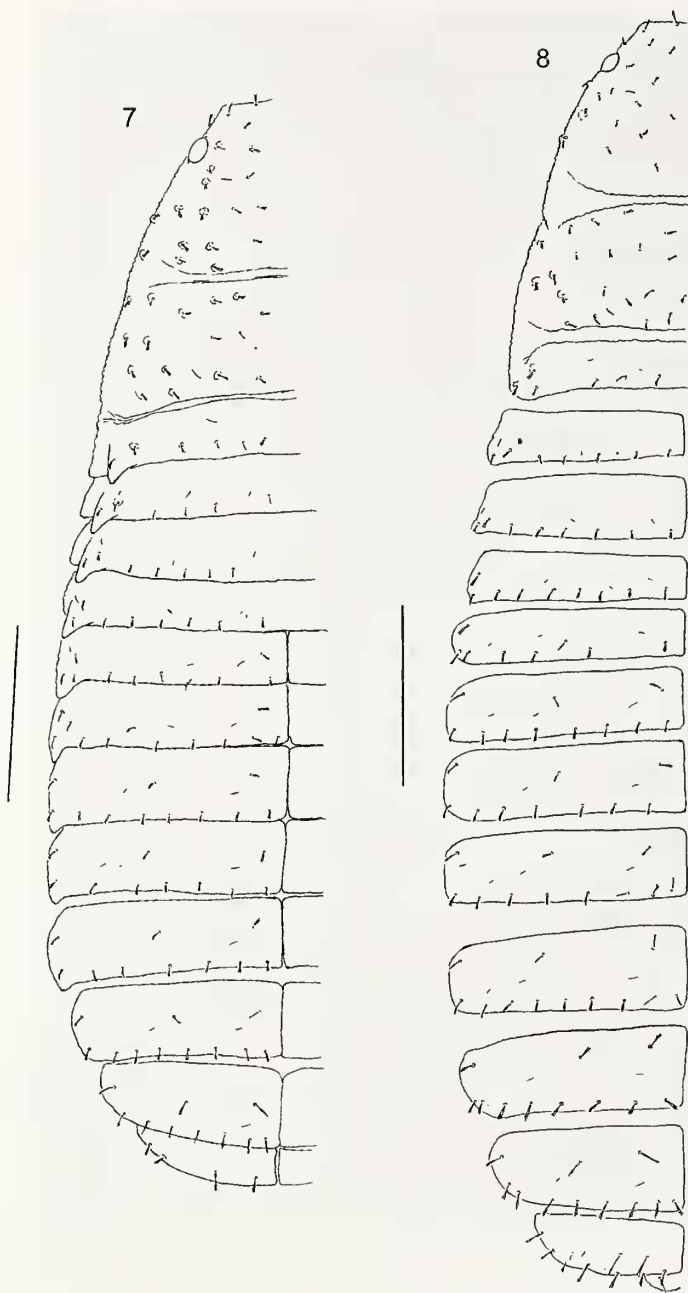
Figures 2-6.—*Chelifer cancroides* (Linnaeus), male from Tasmania, Australia (QVMAG 13_53185): 2. Dorsal; 3. Ventral; 4. Detail of carapace and abdomen, dorsal; 5. Carapace, dorsal; 6. Detail of coxae and abdomen, ventral.

Chelicera: With 4 setae on hand and 1 subdistal seta on movable finger (Fig. 14); seta *sbs* absent; seta *bs* dentate, remaining setae acuminate; seta *bs* shorter than others; with 2 dorsal lyrifissures and 1 ventral lyrifissure; galea of ♂ and ♀ with 5 terminal rami (Figs. 16, 17); rallum of 3 blades, the most distal blade with several serrations on leading edge, other blades smooth (Fig. 15); serrula exterior with 17 (♂, ♀) blades; lamina exterior present (Fig. 14).

Pedipalp (Fig. 18): Surfaces of trochanter, femur and patella coarsely granulate, chela including fingers mostly smooth, prolateral face very lightly granulate; patella with 2 small sub-basal lyrifissures; trochanter 2.25 (♂), 1.97 (♀), femur 5.67 (♂), 5.18 (♀), patella 4.20 (♂), 3.87 (♀), chela (with pedicel) 4.61 (♂), 4.30 (♀), chela (without pedicel) 4.39 (♂), 4.09 (♀), hand (without pedicel) 2.07 (♂), 1.91 (♀) × longer than broad, movable finger 1.16 (♂), 1.20 (♀) × longer than hand. Fixed

chela finger with 8 trichobothria, movable chela finger with 4 trichobothria (Fig. 21): *eb* and *esb* situated basally, *ib* and *ist* sub-basally, *est* and *isb* sub-medially, *et* and *it* subdistally, *est* situated slightly distal to *isb*, and *et* slightly distal to *it*; *t* situated subdistally, *st* situated midway between *sb* and *t*, and *sb* situated much closer to *b* than to *st*; patch of microsetae present on external margin of fixed chela finger near *et*. Venom apparatus present in both chela fingers, venom ducts long, terminating in nodus ramosus midway between *et* and *est* in fixed finger and between *t* and *st* in movable finger (Fig. 21). Chela teeth (Fig. 21) slightly retrorse, becoming rounded basally; fixed finger with ca. 49 (♂), 50 (♀) teeth; movable finger with ca. 52 (♂), 48 (♀) teeth; accessory teeth absent.

Carapace (Figs. 9, 10): 0.98 (♂), 1.00 (♀) × longer than broad; with 1 pair of rounded corneate eyes, which lack a



Figures 7, 8.—*Chelifer cancroides* (Linnaeus), carapace and abdomen, left side: 7. Male (AMNH S-4186.3); 8. Female (AMNH S-2707). Scale lines = 0.5 mm.

tapetum; with 91 (♂), 98 (♀) setae, arranged with 42 (♂), 45 (♀) (including 4 near anterior margin) in anterior zone, 37 (♂), 40 (♀) in median zone, and 12 (♂), 11 (♀) in posterior zone; postero-lateral corner of ♂ with triangular protuberance surmounted by 1 seta; with numerous lyrifissures; with 2 deep furrows, posterior furrow situated closer to posterior carapace margin than to anterior furrow; anterior furrow situated ca. 0.43 (♂), 0.55 (♀) mm from anterior margin, and posterior furrow situated ca. 0.15 (♂), 0.10 (♀) mm from posterior margin.

Coxal region: Maxillae and coxae slightly granulate; manducatory process rounded, with 2 apical acuminate setae, median seta much smaller than lateral seta, with 1 small

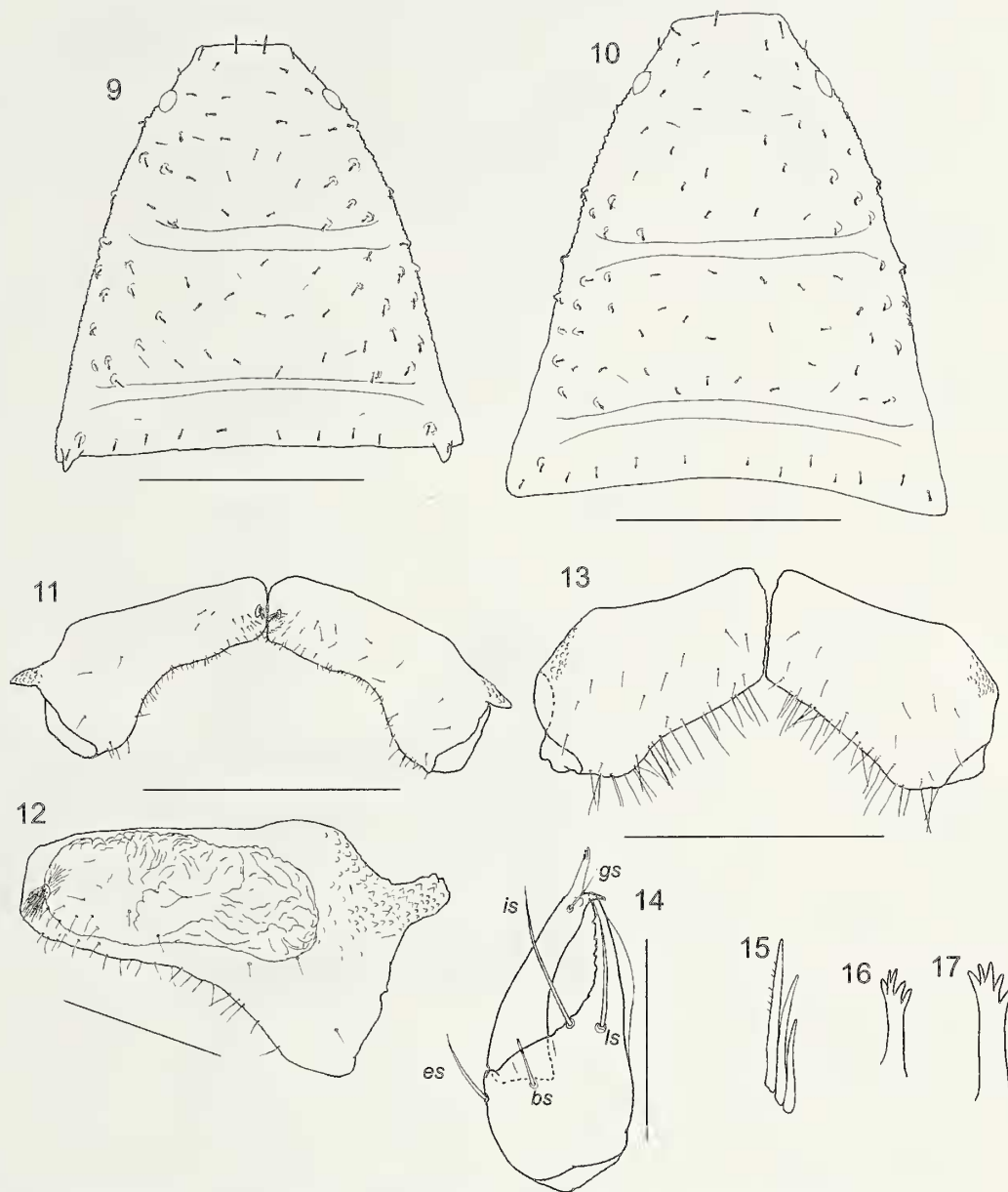
sub-oral seta, and 19 (♂), 20 (♀) additional setae; median maxillary lyrifissure rounded and situated submedially; posterior maxillary lyrifissure rounded. Coxa IV of male (Figs. 11, 12) strongly arcuate and with large lateral processes; large coxal sac without atrium; coxal sac glandular setae long. Chaetotaxy of coxae I–IV: ♂, 11: 13: 43: ca. 70; ♀, 13: 11: 15: ca. 60.

Legs: Trochanter and patella of leg III and IV with dorsal setiferous granules; junction between femora and patellae I and II strongly oblique to long axis; junction between femora and patellae III and IV very angulate; femora III and IV much smaller than patellae III and IV; femur + patella of leg IV 3.17 (♂), 3.34 (♀) × longer than broad; tarsus IV with sub-distal tactile seta, TS ratio = 0.74 (♂), 0.78 (♀); subterminal tarsal setae dentate (Figs. 24, 26); claws of legs (except legs I of ♂) with latero-ventral process (Fig. 26); leg I of ♂ with prolateral claw curved and unmodified, and retrolateral claw slender with dorso-medial sharp process (Figs. 24, 25); tarsus I of ♂ not thickened and without dorsal process or spur (Fig. 24); arolium shorter than claws, not divided (Figs. 24, 26).

Abdomen: Tergites IV–XI of male and I–XI of female with median suture line fully dividing each tergite (Figs. 7, 8); tergites I–III without suture line (Fig. 7); sternites V–XI with medial suture line fully dividing each sternite. Tergal chaetotaxy: ♂, 11: 14: 16: 16: 19: 21: 20: 20: 19: 19: 14: 2; ♀, 15: 17: 17: 19: 20: 22: 20: 22: 20: 19: 14: 2; tergites IV–X biseriate, remainder uniseriate; all setae thickened and strongly dentate; tergites I–VIII of ♂ with lateral triangular keel surmounted with 1 or 2 seta (Fig. 7). Sternal chaetotaxy: ♂, ca. 100: (0) 20 [2+3] (0): (1) 6 (1): 15: 17: 16: 15: 14: 14: 12: 2; ♀, 20: (0) 11 (0): (1) 10 (1): 18: 17: 17: 18: 17: 18: 8: 2; uniseriate, except for sternites II and III, and the lateral discal seta on sternites IV–XI; most setae acicular, but setae on last two tergites becoming slightly clavate and denticulate; ♂ sternite II with arcuate posterior margin (Fig. 29) and with numerous setae, some bifurcate; ♂ sternite III enlarged with arcuate anterior margin and with scattered setae (Fig. 29), some bifurcate (Fig. 30); glandular setae on ♂ sternite III strongly bifurcate; ♀ sternite II with pair of median setae and numerous pairs of posterior setae (Fig. 31). Spiracles with helix. Anal plates (tergite XII and sternite XII) situated between tergite XI and sternite XI. Pleural membrane finely wrinkled-plicate; without any setae.

Genitalia: Male (Figs. 32, 33): lateral apodemes extending laterally; rams horn organs present; lateral rods medially joined and anteriorly invaginated forming a median depression with a sclerotic rod. Female (Fig. 34): with one pair of lateral cribriform plates and 2 pairs of median cribriform plates; with paired thin-walled spermathecae.

Variation: pedipalp: trochanter 1.82–2.07 (♂), 1.67–2.18 (♀), femur 4.78–5.85 (♂), 4.78–5.67 (♀), patella 3.42–4.20 (♂), 3.61–4.29 (♀), chela (with pedicel) 3.86–5.07 (♂), 3.56–5.10 (♀), chela (without pedicel) 3.88–4.41 (♂), 3.35–4.85 (♀), hand (without pedicel) 1.85–2.25 (♂), 1.66–2.31 (♀) × longer than broad, movable finger 0.89–1.20 (♂), 0.96–1.30 (♀) × longer than hand (without pedicel). Femur length mean = 1.201, standard deviation (SD) = 0.087 (♂), mean = 1.222, SD = 0.081 (♀); femur width mean = 0.224, SD = 0.018 (♂), mean = 0.236, SD = 0.017 (♀); chela (with pedicel) length mean = 1.752, SD = 0.139 (♂), mean = 1.795, SD = 0.116 (♀); chela width mean = 0.398, SD = 0.043 (♂), mean = 0.413, SD = 0.040 (♀).



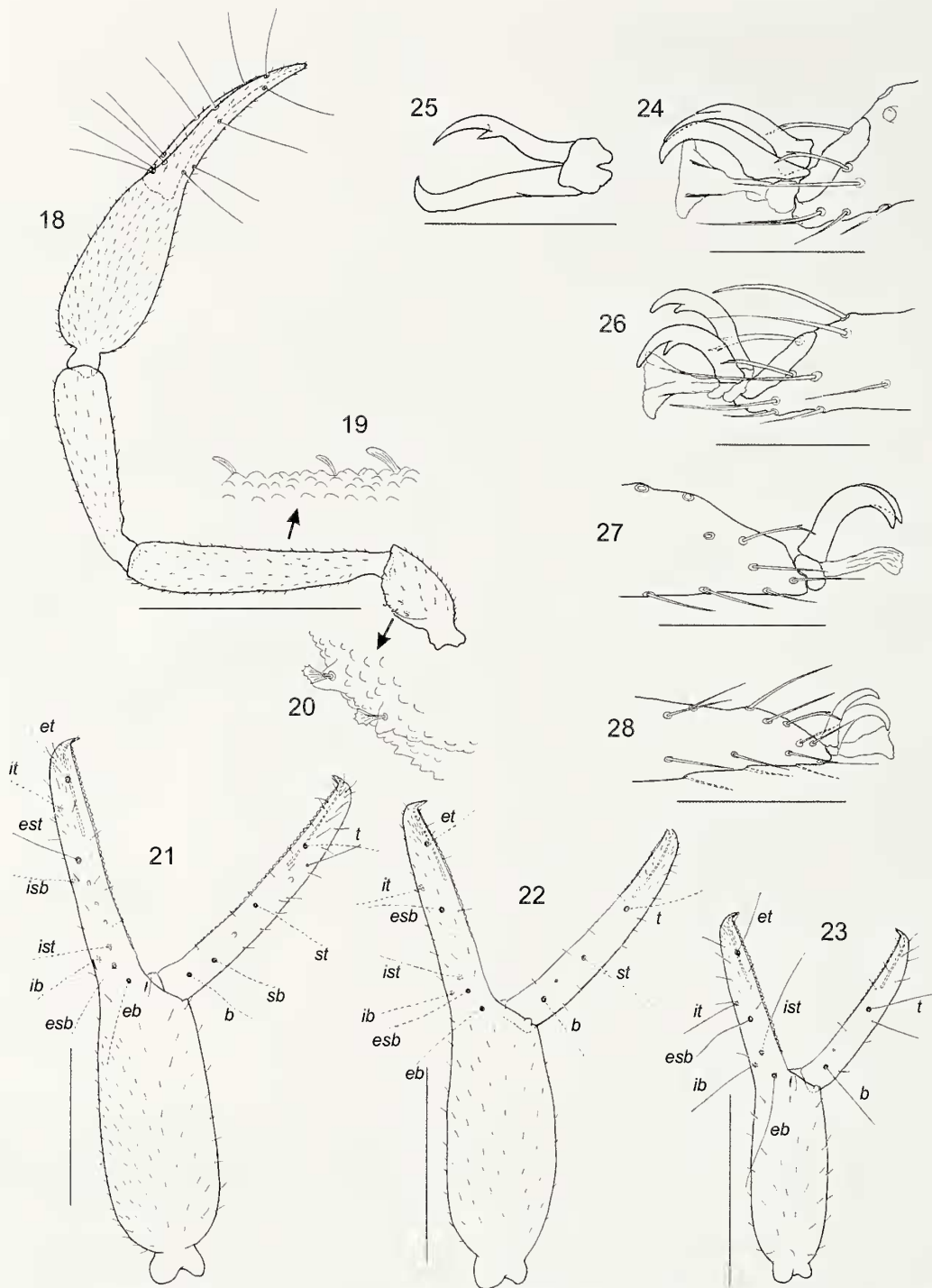
Figures 9–17.—*Chelifer cancroides* (Linnaeus): 9. Carapace, dorsal, male (AMNH S-4186.3); 10. Carapace, dorsal, female (CAS JC-1598.01002); 11. Coxae IV, ventral, male (AMNH S-2706); 12. Left coxa, IV, showing coxal sac, ventral, male (AMNH S-4186.3); 13. Coxae IV, ventral, female (CAS JC-1598.01002); 14. Left chelicera, dorsal, male (AMNH S-4080.2); 15. Rallum, male (AMNH S-4186.4); 16. Galea, male (AMNH S-3509); 17. Galea, female (AMNH S-4186.2). Scale lines = 0.1 mm (Figs. 15–17), 0.2 mm (Figs. 12, 14), 0.5 mm (Figs. 9–11, 13).

Carapace 0.91–1.04 (♂), 0.95–1.09 (♀) × longer than broad; posterior margin with 11–18 (♂), 10–14 (♀) setae; keels usually very prominent, but smaller specimens with keels barely noticeable. Legs: femur + patella IV 2.72–3.84 (♂), 3.07–3.75 (♀) × longer than broad. Abdomen: tergites II and III of male sometimes divided; tergal chaetotaxy: ♂, 12–16: 14–17: 14–20: 15–21: 16–26: 18–26: 19–26: 18–25: 18–23: 17–24: 12–20: 2; ♀, 12–17: 14–18: 14–19: 14–20: 16–22: 17–23: 16–24: 17–22: 16–21: 12–16: 2; ♂ sternite III with glandular setae ranging from [3 + 1] to [4 + 5].

Dimensions: Male from near Pittsburg, Kansas (AMNH, Hoff slide S-4186.4) followed by all other males (where applicable): Body length 2.78 (2.38–3.50). Pedipalps: trochanter 0.505/0.225 (0.405–0.615/0.21–0.315), femur 1.105/0.195

(0.935–1.355/0.185–0.265), patella 0.925/0.22 (0.79–1.15/0.21–0.285), chela (with pedicel) 1.590/0.345 (1.29–2.01/0.30–0.48), chela (without pedicel) 1.515 (1.24–1.875), hand (without pedicel) length 0.715 (0.635–0.895), movable finger length 0.830 (0.60–1.04). Chelicera 0.270/0.130, movable finger length 0.165. Carapace 0.895/0.910 (0.81–1.09/0.85–1.14); eye diameter 0.060. Leg I: femur 0.305/0.175, patella 0.450/0.140, tibia 0.44/0.10, tarsus 0.39/0.085. Leg IV: femur + patella 0.84/0.265 (0.68–1.04/0.185–0.34), tibia 0.665/0.130, tarsus 0.480/0.085, TS = 0.355.

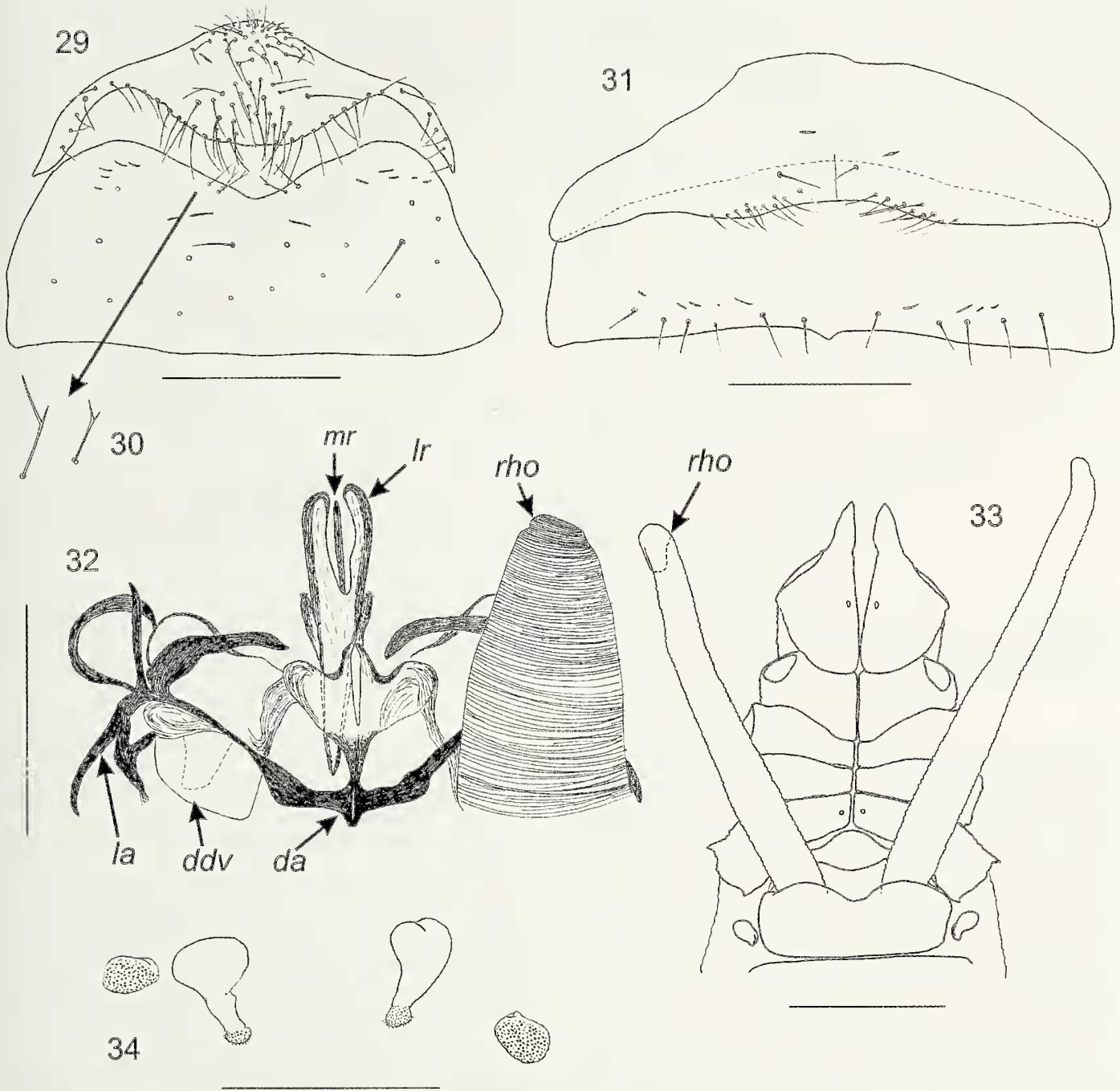
Female from near Pittsburg, Kansas (AMNH, Hoff slide S-4186.2) followed by all other females (where applicable): Body length 3.63 (2.18–3.71). Pedipalps: trochanter 0.570/0.290 (0.445–0.64/0.215–0.335), femur 1.270/0.245 (1.005–1.42/



Figures 18–28.—*Chelifer cancrivorus* (Linnaeus): 18. Left pedipalp, dorsal, male (AMNH S-4186.3); 19. Left pedipalp, detail of prolateral face of femur, male (AMNH S-4186.3); 20. Left pedipalp, detail of retrolateral face of trochanter, male (AMNH S-4186.3); 21. Right chela, lateral, male (AMNH S-4186.3); 22. Left chela (reversed), lateral, tritonymph (CAS JC-257.01002); 23. Right chela, lateral, deutonymph (AMNH S-1995.3); 24. Right tarsus I, lateral, male (AMNH S-4186.3); 25. Claws of left tarsus I, ventral, male (AMNH S-4186.3); 26. Right tarsus I, lateral, female (AMNH S-4186.2); 27. Left tarsus I, lateral, tritonymph (CAS JC-257.01002); 28. Right tarsus I, lateral, deutonymph (AMNH S-1995.3). Scale lines = 0.1 mm (Figs. 19, 20, 24–28), 0.5 mm (Figs. 21–23), 1.0 mm (Fig. 18).

0.19–0.285), patella 1.045/0.270 (0.835–1.21/0.21–0.315), chela (with pedicel) 1.870/0.435 (1.405–2.08/0.305–0.54), chela (without pedicel) 1.780 (1.36–1.94), hand (without pedicel) length 0.830 (0.705–0.90), movable finger length 1.000 (0.68–1.125). Chelicera 0.315/0.165, movable finger length 0.210.

Carapace 1.070/1.075 (0.85–1.17/0.79–1.20); eye diameter 0.065. Leg I: femur 0.360/0.190, patella 0.540/0.165, tibia 0.505/0.100, tarsus 0.495/0.075. Leg IV: femur + patella 1.020/0.305 (0.80–1.20/0.225–0.355), tibia 0.800/0.150, tarsus 0.580/0.105, TS = 0.450.

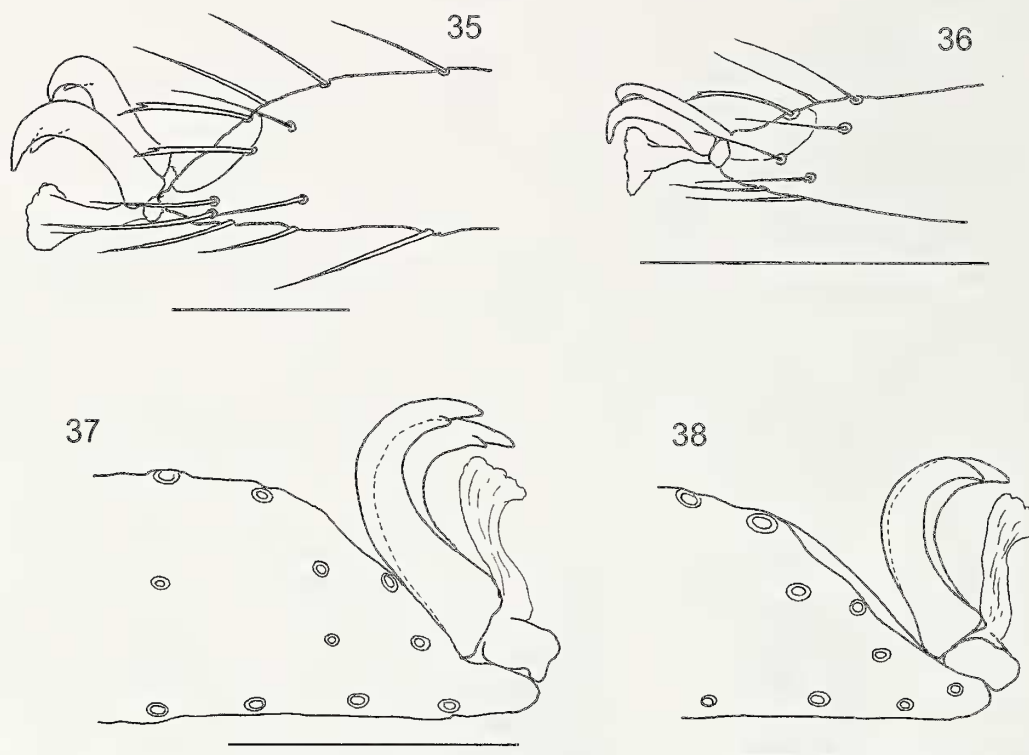


Figures 29–34.—*Chelififer cancroides* (Linnaeus): 29. Sternites III and IV, male (AMNH S-4186.4); 30. Detail of setae; 31. Sternites III and IV, female (AMNH S-4186.2); 32. Genitalia, ventral, male (AMNH S-2706); 33. Genital and coxal region showing distended rams horn organs, ventral, male (CAS JC-1523.01001); 34. Genital region, female (AMNH S-4186.2). Abbreviations: *da* = dorsal apodeme; *ddv* = dorsal diverticulum; *la* = lateral apodeme; *lr* = lateral rod; *mr* = median rod; *rho* = rams horn organs. Scale lines = 0.1 mm (Fig. 32), 0.2 mm (Figs. 29, 31, 34), 0.5 mm (Fig. 33).

Tritonymph from New York, USA. (CAS JC-257.01002):
Color: sclerotized portions generally pale red-brown.

Chelicera: With 4 setae on hand and 1 subdistal seta on movable finger; seta *sbs* absent; seta *bs* dentate, remaining setae acuminate; seta *bs* shorter than others; galea broken, rami not visible; rallum with 3 blades, distal blade with spinules on anterior face, remaining blades smooth; serrula exterior with 14 blades.

Pedipalp: Trochanter 2.03, femur 4.98, patella 3.67, chela (with pedicel) 4.47, chela (without pedicel) 4.23, hand (without pedicel) 2.04 × longer than broad, movable finger 1.09 × longer than hand (without pedicel). Fixed chelal finger with 7 trichobothria, movable chelal finger with 3 trichobothria (Fig. 22): *eb*, *esb*, *ib* and *ist* situated sub-basally, *esb* situated closer to *et* than to *esb*, *et* situated closer to the end of the finger than to *it*, *t* situated subdistally, and *st* situated midway



Figures 35–38.—Tarsal claws showing lack of ventrolateral process in nymphs: 35, 36. *Lophochernes* sp. from Vanuatu (WAM T118590): 35. Left tarsus I, lateral, female; 36. Left tarsus I, lateral, tritonymph. 37, 38: *Parachelifer* sp. from Florida (CAS JC–209.02001–2): 37. Tarsus IV, lateral, male; 38. Left tarsus I, lateral, tritonymph. Scale lines = 0.05 mm (Fig. 35), 0.1 mm (Figs. 36–38).

between *b* and *t*; patch of microsetae present on external margin of fixed chelal finger near *et*. Venom apparatus present in both chelal fingers, venom ducts long, terminating in nodus ramosus midway between *et* and *est* in fixed finger and slightly distal to *t* in movable finger. Fixed finger with 36 teeth; movable finger with 40 teeth.

Carapace: 1.04 × longer than broad; with 1 pair of rounded corneate eyes; with 50 setae, arranged with 24 (including 4 near anterior margin) in anterior zone, 18 in median zone, and 8 in posterior zone; with 2 deep furrows, posterior furrow situated closer to posterior carapace margin than to anterior furrow.

Coxal region: Chaetotaxy of coxae I–IV: 4: 4: 6: 8.

Legs: Femur + patella of leg IV 2.74 × longer than broad; tarsus IV with sub-distal tactile seta, TS ratio = 0.72; subterminal tarsal setae dentate; claws of legs without latero-ventral process.

Abdomen: Tergal chaetotaxy: 10: 11: 11: 12: 11: 14: 13: 14: 12: 10: 4: 2; tergites without lateral keels. Sternal chaetotaxy: 2: (0) 6 (0): (1) 7 (1): 9: 10: 10: 9: 8: 6: 2: 2.

Dimensions: Body length 1.89. Pedipalps: trochanter 0.408/0.201, femur 0.861/0.173, patella 0.704/0.192, chela (with pedicel) 1.261/0.282, chela (without pedicel) 1.192, hand (without pedicel) length 0.575, movable finger length 0.625. Carapace 0.806/0.773. Leg I: femur 0.237/0.154, patella 0.352/0.141, tibia 0.326/0.099, tarsus 0.326/0.086. Leg IV: femur + patella 0.718/0.262, tibia 0.519/0.140, tarsus 0.384/0.090, TS = 0.275.

Deutonymph from Jensen, Utah, USA. (AMNH Hoff slide S–1995.3): Color: sclerotized portions generally pale red-brown.

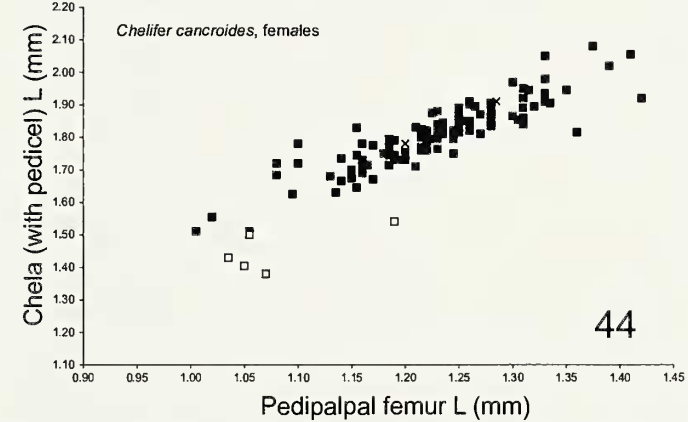
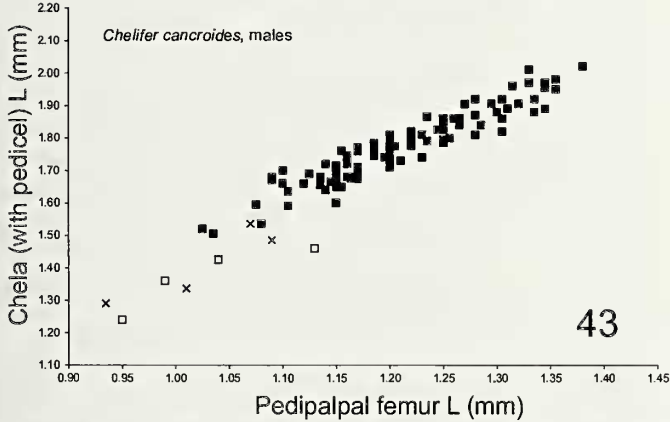
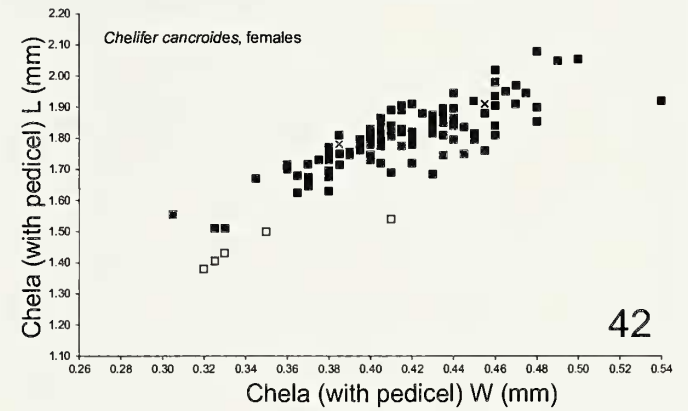
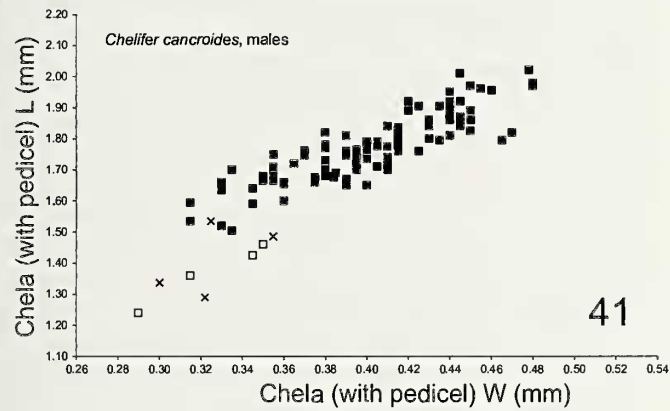
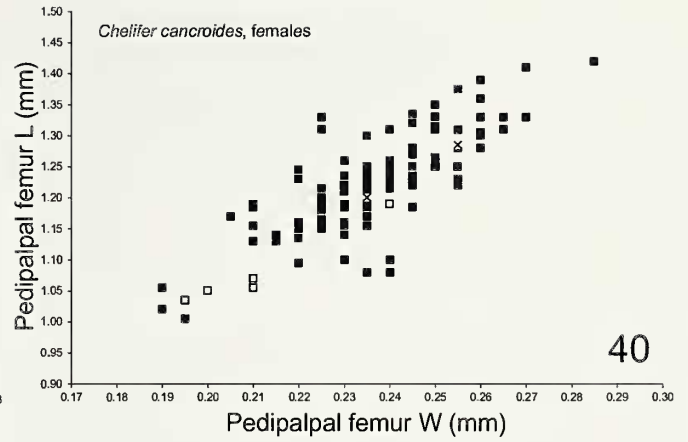
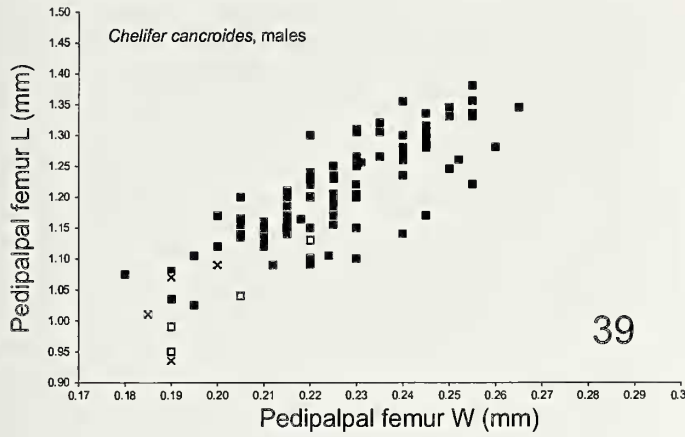
Chelicera: With 4 setae on hand and 1 subdistal seta on movable finger; seta *sbs* absent; seta *bs* dentate, remaining setae acuminate; seta *bs* shorter than others; galea with 4 distal rami; rallum with 3 blades, distal blade with spinules on anterior face, remaining blades smooth; serrula exterior with 13 blades.

Pedipalp: Trochanter 1.75, femur 4.83, patella 2.46, chela (with pedicel) 4.61, chela (without pedicel) 4.43, hand (without pedicel) 2.17 × longer than broad, movable finger 1.08 × longer than hand (without pedicel). Fixed chelal finger with 6 trichobothria, movable chelal finger with 2 trichobothria (Fig. 23): *eb* situated basally, *ib* and *ist* subbasally, *esb* and *it* submedially, *et* subdistally, *it* situated closer to *est* than to *et*; *b* situated basally and *t* situated subdistally; patch of microsetae present on external margin of fixed chelal finger near *et*. Venom apparatus present in both chelal fingers, venom ducts long, terminating in nodus ramosus midway between *et* and *it* in fixed finger and distal to *t* in movable finger. Fixed finger with 37 teeth; movable finger with 38 teeth.

Carapace: 0.96 × longer than broad; with 1 pair of rounded corneate eyes; with 39 setae, arranged with 21 (including 4 near anterior margin) in anterior zone, 14 in median zone, and 4 in posterior zone; with 2 deep furrows, posterior furrow situated closer to posterior carapace margin than to anterior furrow.

Coxal region: Chaetotaxy of coxae I–IV: 4: 5: 4: 4.

Legs: Femur + patella of leg IV 2.87 × longer than broad; tarsus IV with sub-distal tactile seta, TS ratio = 0.68; subterminal tarsal setae dentate; claws of legs without latero-ventral process.



Figures 39–44.—Size variation in adult specimens of *Chelifer cancroides* (Linnaeus): 39, 40. Pedipalpal femur length versus width; 41, 42. Pedipalpal chela (with pedicel) length versus width; 43, 44. Pedipalpal chela length (with pedicel) versus femur length. Asian specimens = open symbols; x = unknown locality; others = closed symbols. Measurements taken from Morikawa (1954) for specimens of *C. cancroides orientalis* (triangles).

Abdomen: Tergal chaetotaxy: 6: 6: 6: 6: 6: 7: 6: 6: 6: 6: 2; tergites without lateral keels. Sternal chaetotaxy: 0: (0) 4 (0): (1) 4 (1): 6: 6: 6: 7: 6: 6: 5: 2.

Dimensions: Body length 2.07. Pedipalps: trochanter 0.285/0.163, femur 0.608/0.126, patella 0.505/0.205, chela (with pedicel) 0.945/0.205, chela (without pedicel) 0.945, hand (without pedicel) length 0.445, movable finger length 0.482. Carapace 0.635/0.661. Leg I: femur 0.176/0.108, patella 0.265/0.102, tibia 0.235/0.071, tarsus 0.260/0.065. Leg IV: femur + patella 0.513/0.179, tibia 0.371/0.100, tarsus 0.287/0.070, TS = 0.195.

Remarks.—*Type material of Acarus cancroides:* The original description of *Acarus cancroides* by Linnaeus (1758) was a few words of Latin: “A[carus], antennis cheliformibus, abdomine ovato depresso” (i.e., an *Acarus* with chelate pedipalps, abdomen ovate, flat), which fails to provide any diagnostic features by which the species can be recognized. Apart from any specimens that Linnaeus (1758) may have had access to, the type series also consists of those specimens examined by the authors cited by Linnaeus (1758) listed under the name *A. cancroides* (International Commission on Zoological Nomenclature 1999, Article 72.4.1). These five

literature sources (Frisch 1730; Seba 1734; Linnaeus 1746; Rösel 1755; Clerck 1758) referring to a species he believed was *A. cancroides* are here discussed in chronological order.

Frisch (1730) contains two pages of text discussing 'Die Scorpion-Spinne', along with a very rudimentary drawing of a pseudoscorpion. The long pedipalps suggest that the species may indeed represent *C. cancroides*, but the provenance of the specimen is uncertain and the identification is somewhat tenuous. This citation was also listed by earlier Linnaeus volumes including Linnaeus (1746). The whereabouts of Frisch's collection – if it still exists – is unknown.

Seba (1734) presents a small illustration of an unidentifiable pseudoscorpion along with a Latin description and a Dutch figure caption that specifically mentions pseudoscorpions living in old walls and old wood. The habitat data suggests that he was referring to *C. cancroides*. Albertus Seba (1665–1736) resided in Amsterdam after moving there in 1696, and it is possible that the pseudoscorpion specimens were obtained locally. Much of Seba's early collections were purchased by Peter the Great in 1716 and transferred to Saint Petersburg, forming the basis for the Kunstkamera Museum (Engel 1937). Seba later developed a second collection, which may have included the pseudoscorpion illustrated in his 1734 volume. After his death the collection was auctioned to a variety of parties, with only a small proportion of it nowadays traceable (Boeseman 1970). The fate of any pseudoscorpions that might have been present in Seba's collection is unknown.

Linnaeus' *Fauna Svecica* (1746) was an early companion volume for *Systema Naturae*, the first edition of which was printed in 1735 (Linnaeus 1735). Pseudoscorpions were listed in his group "Acarus" as "Scorpio-aranus" (Linnaeus 1735). Under *Acarus cancroides*, Linnaeus (1758) refers to Species 1187 of *Fauna Svecica* which is "ACARUS pedibus primi paris cheliformibus" (= "a mite with first pair of legs cheliform"), and the Latin text accompanying the entry translates as "lives in houses that have been closed for a long time, not exposed to air, in chests and cellars" and "easily recognized from the rest by the crablike claws of the first legs and by the backwards gait, living on book lice" (H.D. Cameron, in litt. March 2012). The reference to book lice can be traced through his original Latin expression "pediculo ligni antiqui" which is the name applied to Species 1168 in Linnaeus (1746). This species was later described as *Ternes pulsatorium* Linnaeus 1758, which is nowadays known as *Trogium pulsatorium* (Linnaeus 1758), a small psocopteran, which is a well-known minor pest in houses and other human facilities where they feed on fungal hyphae (e.g., Hall 1988; Smithers 1996; Turner & Ali 1996; New 2005).

Rösel (1755) provided nearly three pages of text describing the habits of a pseudoscorpion, which was depicted in superbly detailed color paintings (Tab. LXIV) of a male, female and a brood-sac. This pseudoscorpion has all the hallmarks of *C. cancroides*, including the general habitus and the proportions of the pedipalpal segments, and there is little doubt of its identity. The illustrations are included in a single plate entitled "Scorpio Minimus", but this Latin name does not appear in the text. After Rösel's death in 1759, the book series was updated and translated into Dutch by C.F.C. Kleeman. These volumes lack any mention of a publication date, but the entire four-volume series was published between

1764 and 1768. The precise publication date of the third volume, which contains the section on pseudoscorpions, is not known. This volume (Rösel von Rosenhof & Kleemann [1764–1768?]) reprinted the same figure (Tab. LXIV) that was originally printed by Rösel (1755). This figure was once again captioned "Scorpio Minimus" and like the earlier volume this name is not mentioned in the text. Although Rösel's original publication (Rösel 1755) predates the starting point of zoological nomenclature in 1758 (International Commission on Zoological Nomenclature 1999), the Dutch version (Rösel von Rosenhof & Kleemann [1764–1768?]) may be deemed an available work and the name "Scorpio Minimus" may be deemed to be an available species-group name. However, there is ample evidence elsewhere in the volume indicating that the figure headings were simply Latin translations of Dutch vernacular names, with "Scorpio Minimus" arising from the Dutch expression "Den Kleinsten Scorpioen" (Rösel von Rosenhof & Kleemann [1764–1768?], p. 317). Elsewhere in the same volume there are various different freshwater crustaceans depicted by Rösel (1755) and Rösel von Rosenhof & Kleemann ([1764–1768?]) under the name "Astacus Fluviatilis". It is clear that these names are simply Latin translations of vernacular names and should not be treated as available species-group names. Indeed, I can find no instance of Rösel von Rosenhof & Kleemann being used as the author of any animal species. The specimens that may have formed the basis for Rösel's plates cannot be traced, and it is assumed that Rösel's collections are lost, as are those of Kleemann (Horn et al. 1990).

Linnaeus (1758) listed Clerck (1758) as the fifth and final bibliographic citation for *Acarus cancroides*. Clerck (1758) published small paintings of a pseudoscorpion and a harvestman that he included in the Swedish and Latin text under an entry on "the so-called two-eyed spiders" (translation). Neither the pseudoscorpion nor the harvestmen were scientifically named (Holm 1978), unlike the spiders treated elsewhere in the volume which are deemed by the International Commission on Zoological Nomenclature to be the only animal names that predate Linnaeus (1758). The pseudoscorpion is not easily recognizable, but it may be the neobisiid *Neobisium carcinoides* (Hermann 1804), which occurs in Sweden (e.g., Tullgren 1899; Lohmander 1939; Harvey 2013). There are no pseudoscorpions in the Clerck collection lodged in the Swedish Museum of Natural History, Stockholm (Dr T. Kronstedt, in litt. 15 May 2012), and any specimens examined by Clerck are regarded as lost.

With the loss or unavailability of specimens used by Frisch (1730), Seba (1734), Rösel (1755) and Clerck (1758), some of which are unlikely to represent *C. cancroides*, the only possible type specimens are those in Linnaeus' own collection. The only surviving known specimens apparently examined by Linnaeus are lodged in the collection of the Linnean Society of London, bearing the numbers 7004 and 7005. Images of these specimens are provided on the Linnean Society's website (<http://www.linnean-online.org/24329/> and <http://linnean-online.org/24330/>, accessed 27 February 2013). Two images are provided of specimen 7004, one of the body and the other of the right pedipalp and labels. The specimen lacks the left pedipalp, and is pinned with a standard entomological pin through the middle of the body, damaging or distorting much of the specimen. Dr

M. Judson (in litt., 7 August 2013) kindly informed me that he has examined this specimen, which is a nymph. The two labels include an old hand-written label “cancroides” and a more recent printed or typed label “6 *Chelifer cancroides* (L.)”. Specimen 7005 is also pinned through the middle of the body, and is accompanied only by a single printed or typed label “7 *Chelifer cancroides* (L.)”. It lacks both pedipalps apart from the left trochanter and femur which are attached to the body. Dr Judson confirms this specimen is a female. Little morphological data can be obtained from the images of the two specimens to ascertain whether these specimens conform to modern diagnoses of the species.

One of these specimens was apparently examined by O.P.–Cambridge (1892), who compared it to specimens collected from human edifices in Britain and deemed them to be conspecific with *C. cancroides*. O.P.–Cambridge (1892, p. 221) clearly referred to a single specimen in the Linnean Society collection but it is impossible to ascertain to which specimen he was referring. O.P.–Cambridge (1892) regarded *Chelifer hermanni* Leach 1817 to be distinct from *C. cancroides*, citing its slightly smaller size, more slender pedipalps and different habitat, occurring under tree bark rather than associated with humans. *Chelifer hermanni* has since been treated as a synonym of *C. cancroides* (e.g., Kew 1911; Beier 1932a). These specimens are considered to represent the only surviving syntypes of *Acarus cancroides*, and further examination is required to obtain more accurate measurements and observations on their morphology.

The provenance of Linnaeus’ specimens of *Acarus cancroides* is not certain, as he only stated “Habitat in Europae umbrosis suffocatis”, which can be translated as “lives in dark constricted places of Europe” (H.D. Cameron, in litt. March 2012). Linnaeus (1746) specifically mentioned these pseudoscorpions living in houses and feeding on psocopterans, and it is possible that his material was found inside buildings. Linnaeus resided for most of his life in Sweden but spent some time abroad, principally in Harderwijk, nowadays located within the Netherlands (Blunt 1971). *Chelifer cancroides* is commonly found in or near human dwellings (e.g., Beier 1963; Mahnert 1981; Zaragoza 2009), and it is not uncommon in southern Sweden where it has been frequently recorded from houses (e.g., Tullgren 1899, 1906; Lohmander 1939). However, the provenance of the specimens in the Linnean collection is uncertain, although Linnaeus clearly stated they came from a European location.

The identities of the other described species of *Chelifer* traditionally treated as synonyms of *C. cancroides* (listed above) are slightly doubtful, as in many cases the type material is lost or has not been examined by recent authorities on the group. Indeed, some may actually represent specimens of *Mesochelifer resslii* Mahnert 1981 rather than *C. cancroides* (see Mahnert 1981; Zaragoza 2009). Exceptions include the type material of *C. hermanni*, which was examined by O.P.–Cambridge (1892) and who, as mentioned above, suggested it represented a distinct species. Kew (1911) and later authors treated *C. hermanni* as a synonym of *C. cancroides*.

Chelifer europaeus is traditionally listed as a synonym of *C. cancroides* and appears to have been introduced as a synonym of the latter species (de Geer 1778). However, Welter-Schultes & Wieland (2012) have recently proposed that volumes 3–7

of *Mémoires pour servir à l’histoire des insectes* and the companion publication by Retzius (1783) be treated as available works, but that the majority of the polynomial names proposed in them be suppressed. *Chelifer europaeus* was not listed amongst the names to be suppressed.

Variation and the identity of Chelifer cancroides orientalis: Substantial size variation was found amongst the adults examined for this study, with the chela (with pedicel) ranging from 1.24–2.02 mm in males and 1.38–2.08 mm in females (Figs. 39–44); the largest specimens are approximately 50% larger than the smallest specimens. The smallest adults include all of the specimens from East Asia (China and specimens intercepted in Florida but originally from South Korea), three males intercepted on ships in Australia, five specimens from North America (one each from Canada, Indiana, New York, Oregon and Tennessee) and one with no collection data (Figs. 39–44). There are, however, no other apparent morphological features that unequivocally separate these specimens from the others. Males of *C. cancroides* typically have triangular keels on the postero-lateral corners of the carapace and the anterior tergites (Fig. 7). Two of the smallest male specimens examined have highly reduced carapaceal and tergal keels. Both specimens have the process on the claw of leg I in a more dorsal position but this may be an artifact of the slide preparation. Curiously, these small specimens (CAS JC–2234.01001 and ANIC) were both taken in quarantine samples. Other small male specimens taken at quarantine (other ANIC specimens) have normal shaped keels and tarsal claws, as do the other small males observed in this study.

The smaller specimens from Asia coincide with the description and dimensions provided by Morikawa (1954) for the specimens he used to describe *C. cancroides orientalis* (Figs. 39–44). This subspecies was based on specimens collected from Sapporo City, Hokkaidō Prefecture, and Mukaijima Island near Onomichi, Hiroshima Prefecture (Morikawa 1954), and was later recorded from Asahikawa, Hokkaidō Prefecture (Morikawa 1960). The specimens from Sapporo were taken from a honey-bee hive and those from Mukaijima Island were collected “at a cliff by the seashore” and “in the books” (Morikawa 1954, 1960). Unfortunately these specimens are not lodged in a public institution and have not been available for study (Dr H. Sato, pers. comm.). Morikawa (1954) suggested that the specimens differed from the nominate subspecies in several features including smaller body length, carapace broader than long, and the pedipalps very long in comparison with the body length. Distinguishing taxa using body length meristics is extremely inadvisable, as this measurement is easily affected by a variety of factors including whether the specimen was gravid, how well fed the specimen was, the mode of preservation and whether or not it has been treated for permanent slide-mounting. Concentrated preservatives will contract the abdominal membranes and artificially foreshorten the length of the specimen. Comparative measurements of complete structures such as the carapace or individual pedipalpal segments provide more reliable data to discriminate between species. Such measurements are, however, also subject to alteration if the structure is flattened or spread during the slide preparation process. The flattening is especially noticeable if the coverslip is not supported in some fashion such as by thin glass rods, glass beads or small strands

of fishing line. Such distortion of the carapace will produce slightly altered carapaceal ratios.

The few specimens examined for this study from East Asia, as well as the type specimens reported by Morikawa (1954), have slightly smaller and narrower pedipalps than most of the remaining specimens from Europe, Russia, North America and Australasia (Figs. 39–44). As there are no other detectable differences between the Asian and non-Asian populations, *C. cancroides orientalis* is here regarded as a junior synonym of *C. cancroides*. Further specimens of the Asian populations are required to better document the intraspecific variation observed in this study.

Postembryonic development.—Two of the three nymphal stages are represented in the material examined for this study, including several tritonymphs and deutonymphs. The number and position of the individual trichobothria of these nymphs and the adults (Figs. 22, 23) are identical to those presented by Vachon (1934c), who also documented the protonymph. Other morphological features are also similar including the number of setae on the posterior zone of the carapace, 4 in deutonymphs ($n = 1$), 8 in tritonymphs ($n = 1$), and 10–18 in adults; Vachon (1934c) reported 6–9 in deutonymphs, 8–12 in the tritonymph, and 11–16 in adults.

Distribution.—*Chelifer cancroides* is widely distributed and frequently recorded in Europe, Central Asia, North Africa and North America. There are, however, far fewer records in other regions of the world and documentation of specimens from the southern temperate regions are even scarcer. The few sub-Saharan African records include the Democratic Republic of Congo (Zaire) (e.g., Beier 1955; Beier 1959), Ethiopia (Simon 1904), Kenya (e.g., Beier 1944, 1967b; Mahnert 1988), Malawi (Beier 1944), South Africa (e.g., Ellingsen 1910; Beier 1929; Hewitt & Godfrey 1929) and Tanzania (Beier 1944). Millot (1948) recorded a species from Madagascar that was claimed to be very close to *C. cancroides*, which Legendre (1972) appears to have accepted as *C. cancroides*. The actual identity of this material should be checked to ascertain its status. Similarly, there are few records from Central and South America with specimens only reported from Argentina (Simon 1895; Ceballos & Ferradas 2008), Brazil (Ellingsen 1910), Chile (Simon 1887, 1895; Cekalovic K. 1976;), Cuba (Banks 1909; Franganillo Balboa 1936) and Mexico (Villegas-Guzmán & Pérez 2005).

The only East Asian records are from the Kamchatka Peninsula, Russia (Redikorzev 1935), Japan (Morikawa 1954, 1960), Mongolia (Krumpál & Kiefer 1982) and Vietnam (Beier 1951, 1967a), but among the specimens examined for this study were two females collected in 'Tsinan' (now Jinan), in Shandong Province, China, which represents the first record of *C. cancroides* from China. The specimens from Kamchatka identified by Redikorzev (1935) were examined and can be confirmed to be correctly identified as *C. cancroides*. Also, a pair collected in Florida in "straw scuffs from South Korea" represents the first record of *C. cancroides* from that country.

The only undisputed published records from the Australasian region are of several specimens collected in New Zealand, which were taken from "timber in insectary" at Owairaka (North Island) in 1945 and from a "nest of *Sturinus vulgaris*" at Kaikoura (South Island) in 1971 (Beier 1976). A newly identified female from New Plymouth (North Island)

collected in 1924 from an ants' nest (CAS JC-544.01001) represents the earliest recorded specimen from the Australasian region. Recently, large numbers of *C. cancroides* were obtained from nests of the lucerne leafcutting bee *Megachile rotundata* (Fabricius 1787) in Christchurch (South Island) (B. Donovan, in litt. December 2012), some of which were examined for this study. The bee is native to Eurasia and was deliberately introduced into New Zealand in 1971 to assist in the pollination of lucerne (Howlett & Donovan 2010).

An early record of *C. cancroides* from Mount Lofty, near Adelaide, South Australia, by Beier (1930) was discounted by Harvey (1981) who regarded the identification of the single, apparently juvenile, specimen ("1 semiad. ♀") as doubtful. Harvey (1981) noted that *C. cancroides* was not included in subsequent synopses of the Australian fauna by Beier (1948b, 1966), and it is likely that the specimen from Mount Lofty was a misidentified member of the cheliferid genus *Protochelifer* Beier, which is common in southern and eastern Australia. The four male specimens of *C. cancroides* reported here from the Launceston region in northern Tasmania represent the first undisputed occurrence of *C. cancroides* from Australia. The specimens were collected inside a house in 1930, from straw in 1977 and without habitat data in 1985, indicating that the species is established in the area and has persisted for several decades.

Chelifer cancroides has been reported from a variety of states of the USA and provinces of Canada, and among the specimens examined for this study are several new state or provincial records: Connecticut, New Jersey, South Carolina, Tennessee and Washington in the USA, and New Brunswick and Saskatchewan in Canada.

The male specimen from near Baker, Oregon listed as *C. cancroides* by Benedict & Malcolm (1979) has been reexamined and found to belong to the genus *Parachelifer*. However, it was not possible to identify the specimen to species due to the poor condition of the slide preparation.

Harvey (1991) listed distribution records from Ghana and India, which were repeated in subsequent on-line catalogs (e.g., Harvey 2011). This Ghana record cannot now be verified and is presumed to be an error by Harvey (1991). The Indian record was based on Sharma & Sharma (1975), who reported many specimens of a species suggested to represent a new species of *Chelifer* from Jammu and Kashmir State in northern India, principally from buildings. Until further specimens are examined to verify the identification of these populations, it seems prudent to remove *C. cancroides* from the list of recorded Indian species.

Habitat.—*Chelifer cancroides* has been frequently reported from houses and associated human edifices such as barns, stables, bee hives and chicken coops (e.g., Vachon 1935; Beier 1939, 1948a, 1963; Hoff 1949; Levi 1953; Legg & Jones 1988), where they feed on a variety of small invertebrates (e.g., Kästner 1931; Vachon 1932; Schlottke 1933, 1940; Levi 1953).

Records of *Chelifer cancroides* from caves appear to be non-existent, but Mr J. Zaragoza (in litt., 6 August 2013) has informed me of a sample of seven males, five females, and a tritonymph obtained by Berlese funnel extraction of dried bat guano from Cova dels Moseguellos cave, Vallada, Valencia, Spain (UTM 696400 4308700). The specimens do not exhibit any particular adaptations to cave life, although some are in the extreme range of the measurements given above.

Specimens have been very occasionally found on humans (Hermann 1804; André 1908, 1909a, 1909b; Artault de Vevey 1901; Vachon 1938a), and some have been observed to feed on the bed bug *Cimex lectularius* Linnaeus 1758 (Hemiptera: Cimicidae). Frickhinger (1920) reported observations made by a German prisoner of war held in 1915–1918 near Yekaterinburg, Sverdlovskaya oblast, Russia, who watched specimens of *C. cancroides* feeding on bed bugs. The pseudoscorpions emerged at night from the walls of the dwelling, but were never encountered in beds. Kaisila (1949) reported that *C. cancroides* has been observed feeding on bed bugs in Finland. A male *C. cancroides* collected in Wageningen, Netherlands in 1927 (CAS JC-281.01001) was taken from a "*Cimex* infested house", with an adult bug mounted on the slide alongside the pseudoscorpion.

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APPENDIX 1

The specimens studied in this study.

Chelifer cancrivorus (Linnaeus 1758)

AUSTRALIA: *Tasmania*, 2 ♂, Cressy, 6 December 1985, A. Harker (QVMAG); 1 ♂, Launceston, 5 July 1930, in house (bath), collector not stated (TMAG, J3110); 1 ♂, Launceston, 18 March 1977, in straw (one of many), A. Colvill (QVMAG, 13:6864).

CANADA: *New Brunswick*, 1 ♀, Saint Johns, no date, ex R.V. Chamberlin (CAS JC–1166.01001); *Ontario*, 2 ♂, 2 ♀, Westport, 29 September 1973, guano, S. Peck (FSCA WM3482.01–2); 1 ♀, Lake of the Woods, Sioux Narrows, April 2001, W. Kobel (FSCA WM8512.01001); *Quebec*, 1 ♀, Montreal, 30 September 2005, in house, C. Cloutier (WAM T67083); *Saskatchewan*, 1 ♂, 1 ♀, Lady Lake, 13 October 1931, D.J. Buckle (FSCA WM2050).

CHINA: *Shandong*, 1 ♀, Tsinan [=Jinan], 7 December 1922, on table, 2nd floor of house, Jacot (CAS JC–1418.02001); 1 ♀, Tsinan [=Jinan], 19 February 1925, in house, Jacot (CAS JC–1418.01001); *Province unknown*, 1 ♂, from China, at quarantine in New York, 2 November 1949, alive in shipment, dried orange peel, collector not stated (CAS JC–2234.01001).

CZECH REPUBLIC: *Hlavní mesto Praha*, 1 ♀, Praha, Leopoldova Street, 12 May 1998, inside building, F. Štáhlavský (WAM T78673).

“CZECHOSLOVAKIA”: 1 ♀, at quarantine in Miami, Florida, 26 July 1948, in mail shipment, dry mushrooms, B.P. Stewart & R.C. Watson (CAS JC–2177.01001).

DENMARK: 1 ♂, no further locality, no date, collector not stated (CAS JC–655.01001) (det. by Schiödte as *Chelifer granulatus*).

FRANCE: 1 ♂, 2 ♀, 1 tritonymph, no further data (WAM T78672).

GERMANY: 1 ♀, from Germany at Cleveland, Ohio, 3 May 1945, in hay packing material, U.R. Kuhn (CAS JC–2022.01001); 1 ♂, 1 ♀, Germany, no further data, no date, A. Walesuch (CAS JC–1481.01001–2); 1 ♂, in wood wool in packing case from Germany; intercepted in Australia, 30 September 1936 (QM W674).

ITALY: 1 ♂, ex Italy, at quarantine in New York, 15 September 1947, alive in garlic bulb, Fonner & Hidalgo (CAS JC–2155.01001); 2 ♀, 1 tritonymph, ex Italy, at quarantine in New York, 29 October 1948, in basket of grapes, Inspector Plummer (CAS JC–2181.01001–3).

NETHERLANDS: *Gelderland*, 1 ♂, Wageningen, 20 December 1927, in *Cimex* infested house, F. Spruyt (CAS JC–281.01001); 1 ♂, 1 ♀, Wageningen, 10 July 1928, from covers and straw of bee hives, F. Spruyt (CAS JC–1474.01001–2).

NEW ZEALAND: *Canterbury*, 5 ♂, 1 km S. of Prebbleton, 19 November–20 December 2012, in nests of the lucerne leafcutting bee *Megachile rotundata* in shed, B. Donovan (WAM T120948, T130746); *Taranaki*: 1 ♀, New Plymouth, July 1924, in ant’s nest, W. Smith (CAS JC–544.01001).

POLAND: 20 ♂, 10 females, 1 tritonymph, laboratory colony in Wrocław, originally from Lower Silesia, 7 March 2013, I. Jędrzejowska (WAM T130754–130755).

SOUTH KOREA: 1 ♂, 1 ♀, Florida: Palm Beach County: Farmer’s Market, 12 March 1962, in straw scuffs from South Korea, R.A. Long (FSCA WM3185.01001–2).

RUSSIA: *Kamchatka Krai*, 1 ♂, 2 ♀, Petropavlosk, 26 January 1921 (NHRS, GULI00000403).

SWEDEN: *Blekinge*, 1 ♂, Baggeboda, 19 June 1940, Butovitsch (NHRS, GULI000004105); *Gotland*, 1 ♂, Gotska Sandön, A. Jansson

(NHRS, GULI000004104); *Småland*, 1 ♀, locality label not legible, 9 June 1946 (NHRS, GULI000004106); *Province not determined*, 2 ♂, 4 ♀, without precise data, 3 July 1946 (NHRS, GULI000004107); 1 tritonymph, without precise data (NHRS, GULI000004100); 2 ♂, 2 ♀, without precise data (NHRS, GULI0000040101, T. Thorell collection).

USA: *Alabama*, 1 ♀, Lee County: Auburn, no date, R.V. Chamberlin (CAS JC–657.01001); *Alaska*, 1 ♂, Denali Borough: Mount McKinley, [Denali] National Park, 21 February 1958, from mouse feces in hotel, Corson (AMNH, Hoff S–3587); *California*, 1 ♀, El Dorado County: Herus, Placerville, 16 October 1912 (CAS JC–662.01001); 1 ♂, Santa Clara County: Mayfield, no date, F. Sproyt (CAS JC–279.01001); 1 ♀, Santa Clara County: Stanford University, no date, J.C. Chamberlin (CAS JC–1791.01001); 1 ♂, Tulare County: Visalia, no date, ex R.V. Chamberlin (CAS JC–1760.01001); *Connecticut*, 1 ♀, Fairfield County: Stamford, Bartlett Tree Research Laboratory, 2 October 1945, S.W. Bromley (CAS JC–2151.01001); 1 ♂, Tolland County: Storrs, University of Connecticut, herbarium, November 1945 (AMNH, Hoff S–2634); *District of Columbia*, 1 ♀, Washington D.C., no date, ex R.V. Chamberlin (CAS JC–286.03001); *Florida*, 1 ♀, Miami-Dade County: Miami, International Airport, 27 May 1960, on stable floor, J.L. Weaver (FSCA Hoff S–4126); *Idaho*: 4 ♂, 3 ♀, Bear Lake County: Fish Haven, Bear Lake, 5 Sept. 1921, ‘under bark of balsam log’, ‘under bark of balsam post’ or ‘bark of logs or slabs of fir’, J.C. Chamberlin, B. Cain (CAS JC–676.01001–2, 5, JC–676.02001–4); 2 ♂, 1 ♀, Canyon County: Notus, 25 August 1932, W. Ivie (CAS JC–1350.01001–3); 1 ♂, Twin Falls County: Castleford Plot, 1932, debris, site of old barn, D.E. Fox and R.L. Piemeisel (CAS JC–1178.02001–2); 1 ♀, Twin Falls County: Twin Falls, 28 May 1935, from house (CAS JC–919.01001); *Illinois*, 1 ♀, Champaign County: Champaign, 29 July 1940, attacking people, R. Lehman (CAS JC–995.01001); 1 ♀, Chicago, 12 October 1910, A.W. Slocum (CAS, Hoff 6051–S–533); 1 ♀, Cook County: Glencoe, 22 June 1942, E. Best (CAS, Hoff 6052–S–534); 1 ♂, Cook County: Glencoe, 12 September 1941, M. Best (CAS, Hoff 6049–S–531); 1 tritonymph, Effingham County: Shumway, 1 November 1937, L.E. Richter (CAS, Hoff 6047–S–529); 1 ♂, Greene County: Roodhouse, 1938, from cattle, F.W. Helm (CAS JC–1057.01001); 1 ♀, Lake County: Waukegan, May 1940, H. Sorensen (CAS, Hoff 6055–S–536); 1 ♂, 1 ♀, north-central Illinois, 24 May 1938, in dwelling, C.L. Metcalf (CAS JC–1051.01001–2); *Indiana*, 1 ♂, Kosciusko County: Winond Lake, 3 July 1927, on weeds, Nester (CAS JC–423.01001); 1 ♂, LaGrange County: Shippshewana, no date, under tin of chicken coop, Nester (CAS JC–410.01001); 1 ♂, Monroe County: Bloomington, 27 May 1927, oak fence rail, Nester (CAS JC–419.01001); 1 ♀, Monroe County: Bloomington, 1 June 1927, in house, Nester (CAS JC–421.01001); *Kansas*, 1 ♂, Crawford County: 4 miles E. and ½ mile S. of Pittsburg, 2 June 1963, B. Branson (AMNH, Hoff S–4187.1); 2 ♂, 1 ♀, Crawford County: 5 miles E. and 3 miles S. of Pittsburg, 22 May 1964, in barn, B. Branson (AMNH, Hoff S–4186.2–4); 1 ♂, McPherson County: Mound Ridge, 24 August 1934, in flour mill, N.E. Good (CAS JC–832.02001); 1 ♂, 1 ♀, Riley County: Manhattan, 3 July 1933, bottom poles of haystack, R.C. Smith (CAS JC–1201.01001–2); Kentucky, 1 ♂, Breathitt County: Quicksand, 25 June 1925, ex C.R. Crosby (CAS JC–1523.01001); *Maine*, 1 ♀, Hancock County: Brookline, no date, ex R.V. Chamberlin (CAS JC–1506.01001); *Massachusetts*, 2 ♀, Middlesex County: Groton, 8 June 1937, in barn swallow nest, E.A. Mason (CAS JC–1040.01001–2); *Michigan*, 1 ♂, Ingham County: East Lansing, July 1925, in house, R.H. Pettit (CAS JC–542.01001); *Missouri*, 1 ♂, Greene County: Springfield, no date, ex R.V. Chamberlin (CAS JC–1202.01001); *Montana*, 1 ♂, Garfield County: Jordan, 15 May 1927, collector not stated (CAS JC–632.01001); 1 ♂, Missoula County: Missoula, 1 May 1958, H.F. Pollmann (AMNH, Hoff S–4256); 1 ♂, Ravalli County: Hamilton, 1 March 1934, W.L. Jellison (CAS JC–1096.01001); 1 ♀, Ravalli County: Hamilton, 12 September 1932, laboratory, C.B. Philip (CAS JC–1112.01001); 1 ♀, Ravalli County, 20 May 1934, W.L.

Jellison (CAS JC-1121.01001); 1 ♂, no locality or date, Brunson (AMNH, Hoff S-2530); 1 ♂, no locality or date, Brunson (AMNH, Hoff S-2533); Nevada, 1 ♂, Elko County: Elko, 21 May 1935, in flour, M.W. Menke (CAS JC-829.01001); *New Hampshire*, 2 ♀, Grafton County: New Franconia, no date, ex R.V. Chamberlin (CAS JC-1487.01001-2); 1 ♂, Grafton County: Wentworth, 20 April 1957, H.M. van Deusen (AMNH, Hoff S-3509); *New Jersey*, 1 ♂, Bergen County: Ramsey, Gertsch (AMNH, Hoff S-1482); 1 ♀, Bergen County: Ramsey, September 1948, Gertsch (AMNH, Hoff S-1518); 1 ♀, Bergen County: Ramsey, June 1941, Gertsch (AMNH, Hoff S-1480); 1 ♂, Ocean County: Lakehurst, 2 October 1909 (AMNH, Hoff S-2648.1); *New Mexico*, 1 ♂, Bernalillo County: Albuquerque, 20 April 1961, from milk filter testing equipment (AMNH, Hoff S-41.70); *New York*, 1 ♀, Albany County: Albany, 6 August 1914, sandy woods, ex S.C. Bishop (CAS JC-1592.01001); 1 ♀, Albany County: Lincoln Pond, Huyck Preserve, Rensselaerville, 6 July 1949, J.C. Bishop (AMNH, Hoff S-2655); 1 ♀, Albany County: Voorheesville, 27 June 1934, barn swallow nest, D. Stoner (CAS JC-824.01001); 1 ♀, Chenango County: New Berlin, 22 August 1916, collector not stated (CAS JC-241.01001); 1 ♀, Dutchess County: Poughkeepsie, 19 August 1939, J.H. Fulton (CAS JC-991.01001); 3 ♂, 4 ♀, Genesee County: Bergen Swamp, 6 September 1965, collector not stated (FSCA WM827.01001-6, 8); 1 ♀, Monroe County: Penfield, July 1960, in house, collector not stated (FSCA WM359.01001); 1 ♀, Nassau County: Sea Cliff, no date, ex R.V. Chamberlin (CAS JC-298.07002); 1 ♂, Nassau County: Sea Cliff, no date, ex R.V. Chamberlin (CAS JC-298.04001); 1 ♀, Nassau County: Sea Cliff, no date, ex R.V. Chamberlin (CAS JC-298.07001); 1 ♀, 1 tritonymph, Nassau County: Sea Cliff, no date (CAS JC-257.01001-2); 1 ♀, Nassau County: Westbury, Long Island, June 1949, D.G. Nichols (AMNH, Hoff S-2656); 1 ♀, New York County: New York (AMNH, Hoff S-1541); 1 ♀, Oneida County: New Hartford, 12 March 1901, S.C. Bishop (CAS JC-1688.01001); 1 ♀, Steuben / Yates Counties: Lake Keuka, May 1904, June 1904, ex C.R. Crosby (CAS JC-1656.01001); 1 ♂, 1 ♀, Suffolk County: Babylon, 14 September 1930, F. Spruyt (CAS JC-1598.01001-2); 1 ♂, Sullivan County: Beaver Kill, 25 August 1947, R.B. Fischer (AMNH, Hoff S-2657); 1 ♂, Sullivan County: Beaver Kill, 14 July 1946, R.B. Fischer (AMNH, Hoff S-2654); 1 ♂, 1 ♀, Tompkins County: Groton, February 1960, in hay barn, H. Dietrich (AMNH, Hoff S-4080.1-2); 2 ♂, 1 ♀, Tompkins County: Ithaca, 1 August 1887 (CAS JC-661.01001-3); 1 ♀, New York, Tompkins County: Ithaca, April 1966, collector not stated (FSCA WM899.01001); 1 ♂, Tompkins County: Slaterville (now Slaterville Springs), 6 July 1929, P.R. Needham (CAS JC-1572.01001); *North Carolina*, 1 ♂, Currituck County: Shawboro, 14 April 1937, J.K. Duncan (CAS JC-1027.01001); *Ohio*, 1 ♂, Lawrence County: South Point, 20 April 1934, in poultry house, H.C. Mason (CAS JC-855.01001); 1 ♂, Columbus, no date, in cellar under seed, C.M. Weed (CAS JC-1541.01001); *Oregon*, 1 ♂, Baker County: 10 miles W. of Baker, 7 August 1963, J.S. Buckett (CAS, EB.E-581.01001); 1 ♀, Baker County: Huntington, 5 May 1934, W.L. Jellison (CAS JC-1109.01001); 1 ♀, Benton County: Alesa, November 1920, J.E. Davis (CAS JC-1186.01001); 1 ♂, Benton County: Corvallis, 13 May 1936, on human being, in bathroom, Wheeler (CAS JC-831.01001); 1 ♀, Benton County: Corvallis, 14 May 1936, on human being, in bathroom, N. Larson (CAS JC-831.02001); 1 ♀, Benton County: Corvallis, 20 April 1940, from house, S.J. Couper (CAS JC-1087.01001); 1 ♀, Benton County: Corvallis, May 1936, Prof. Scullen (CAS JC-1185.01001); 1 ♀, Benton County: Corvallis, 20 April 1940, from house, S.J. Couper (CAS JC-1087.01002); 1 ♀, Benton County: Corvallis, 18 April 1938, E. Crumb (CAS JC-1082.01001); 1 ♂, Benton County: Corvallis, spring 1935, J.M. Pierson (CAS JC-1875.01001); 1 ♀, Benton County: Corvallis, 26 May 1935, C.E. Cody (CAS JC-1872.01001); 1 ♂, Benton County: Corvallis, 14 June 1939, in college building, V. Shattuck (CAS JC-915.02001); 1 ♀, Benton

County: Corvallis, 20 March 1937, in shaving soap container in bathroom, D. Edwards (CAS JC-898.02001); 1 ♂, Clackamas County: Wilsonville, no date, in house, G. Danforth (CAS JC-1062.01001); 1 ♀, Clackamas County: Wilsonville, May 1938, from house, G. Danforth (CAS JC-1062.01002); 1 ♂, Deschutes County: Redmond, 28 April 1939 (AMNH, Hoff S-2025.1); 1 ♀, Deschutes County: Redmond, 28 April 1939 (AMNH, Hoff S-2025.2); 1 ♂, Harney County: P Ranch, 1 mile E. of Frenchglen, 12 May 1972, dung & hay, E.M. Benedict (CAS, EB.E-32.01001); 1 ♀, Jackson County: Medford, 7 July 1935, L.G. Gentner (CAS JC-1454.01001); 1 ♂, Lane County: 2.5 miles E. of Cheshire, 4 December 1971, shed, hay, nests and swallow debris, E.M. Benedict (CAS, EB-195.01001); 1 ♂, Marion County: Salem, 15 September 1945, from dead peach limb, J. Schuh (CAS JC-2246.01001); 1 ♀, Multnomah County: Gresham, 10 June 1944, found in bed in house, J. Schuh (CAS JC-2051.01001); 1 ♀, Wasco County: The Dalles, 23 June 1939, in house, presented by D.C. Mote (CAS JC-850.02001); 1 ♂, no further data, summer 1922, in sugar bowl, B.C. Cain (CAS JC-680.01001); *South Carolina*, 1 ♀, Pickens County: Clemson, 21 October 1962, J.A. Payne (FSCA WM528.01001); *Tennessee*, 1 ♀, Anderson County: Oak Ridge, 11 July 1960, A. Lawler (FSCA WM360.01001); *Utah*, 1 ♀, Box Elder County: Park Valley, 9 September 1932, R.V. Chamberlin (CAS JC-1605.01001); 1 ♂, Cache County: Logan, 8 August 1940, in chinchilla nest, G.F. Knowlton (CAS JC-996.01001); 1 ♀, Cache County: Logan, 20 March 1913, H.R. Hagen (CAS JC-627.01001); 1 ♀, Salt Lake County: East Millcreek, no date, under board, old hen coop, J.C. and O.W. Chamberlin (CAS JC-1209.01001); 1 ♂, Salt Lake County: Salt Lake City, no date, R.V. Chamberlin (CAS JC-1212.01001); 9 ♂, 5 ♀, Salt Lake County: Salt Lake City, September 1921, in ruins of old hen coop, B.C. Cain (CAS JC-228.01001, 2, 11-19, 24-26); 1 ♂, Salt Lake County: Salt Lake City, 14 April 1923, laboratory, ex R.V. Chamberlin (CAS JC-1234.01001); 1 ♂, Salt Lake County: Salt Lake City, September 1921, in old hen coop, B.C. Cain (CAS, no number); 1 ♂ (genitalia & chelicerae only), Salt Lake County: Salt Lake City, no date, collector not stated [CAS JC-258.01020 (2 slides)]; 1 ♂, Salt Lake County: Salt Lake City, no date, ex R.V. Chamberlin (CAS JC-1723.01001); 1 ♀, 1 deutonymph, Uintah County: Jensen, 7 November 1952, ex nest of *Peromyscus maniculatus*, D.E. Beck (AMNH, Hoff S-1995.1-3); 1 ♀, Utah County: Goshen, no date, R.V. Chamberlin (CAS JC-282.01001); 1 ♀, Washington County: Saint George, 1926, ex R.V. Chamberlin (CAS JC-1226.02001); 1 ♂, Emery County: San Rafael, 20 April 1928, A.M. Woodbury (ex R.V. Chamberlin) (CAS JC-1230.01001); 1 ♂, 1 ♀, Emery County: San Rafael River, 20 April 1928, A.M. Woodbury (ex R.V. Chamberlin) (CAS JC-1215.02001-2); *Virginia*, 1 ♂, Falls Church City: Falls Church, no date, R.V. Chamberlin (CAS JC-3.04001); *Washington*, 1 ♀, Pierce County: Puyallup, 27 March 1934, W.W. Baker (CAS JC-1812.01001); 1 ♂, Pierce County: Puyallup, 20 June 1932, C.W. Geteendaner (CAS JC-1923.01001); 1 ♀, Pierce County: Puyallup, no date, L.L. Stitt (CAS JC-2101.01001); 1 ♀, no further data, no date, ex R.V. Chamberlin (CAS JC-1560.01001); *Wisconsin*, 1 ♂, Crawford County: Prairie du Chien, June 1949, Levi and Smethurst (AMNH, Hoff S-2706); 1 ♂, 1 ♀, Dane County: Madison, Levi (AMNH, Hoff S-2717.1-2); 1 ♀, Dane County: Verona, February 1947 (AMNH, Hoff S-2715); 1 ♂, Marathon County: Wausau, 27 January 1950, in kitchen, Levi (AMNH, Hoff S-2674); 1 ♀, Marathon County: Wausau, May 1952, in house, Levi (AMNH, Hoff S-2707); 1 ♀, Oneida County: Hazelnurst, 19 August 1949, Levi (AMNH, Hoff S-2679); 1 ♀, Sauk County: Badger, April 1944, in house, Levi (AMNH, Hoff S-2675).

UNITED KINGDOM: *England*, 1 ♂, 1 ♀, Seabrook, Essex, no date, C. Warburton (CAS JC-660.01001-2).

NO DATA: 1 ♀, ex R.V. Chamberlin (CAS JC-1536.02002); 2 ♂ (CAS JC-29.02001-2); 1 ♀, ex R.V. Chamberlin (CAS

JC-1528.01001); 1 ♂, from the ship 'Mararita' at Newcastle, New South Wales, Australia, 31 August 1964, R.G. Winks (ANIC); 1 ♂, from the ship 'Alexandros' at Newcastle, New South Wales, Australia, 5 September 1964, R.G. Winks (ANIC); 1 ♂, from the ship 'Alexandros' at Geelong, Victoria, Australia, 18 September 1965, H. Caple (Department of Primary Industries Inspector) (ANIC).

Lissochelifer sp. ex Western Australia

AUSTRALIA: *Western Australia*, 3 ♂, 2 ♀, Mt Trafalgar, 15°16'50"S, 125°04'05"E, 12 June 1988, under bark, B.Y. Main (WAM T78668); 1 tritonymph, Mt Trafalgar, 15°17'S, 125°04'E, June 1988, litter, J. Majer (WAM T78669).

Lissochelifer sp. ex Queensland

AUSTRALIA: *Queensland*, 11 ♂, 7 ♀, 2 tritonymphs, Palmerville Station, 16°00'S, 144°05'E, 30 June 1997, under bark of rotting logs, F.D. Stone (WAM T118592).

Lophochernes sp. ex Vanuatu

VANUATU: 1 ♀, 2 tritonymphs, Vanuatu, 28 August 2000 (quarantine intercept in Australia) (WAM T118590); 1 ♂, Vanuatu, 17 July 2000 (quarantine intercept in Australia) (WAM T118591).

Parachelifer sp.

USA: *Florida*, 1 ♂, 1 tritonymph, Ormond [probably Ormond Beach], no date, R.V. Chamberlin (CAS JC-209.02001-2).